

Energy Future System Operator Consultation Storelectric Response

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Introduction

It is totally true that “the scale of our ambition for the energy system can only be delivered through a governing architecture to match.” This plan does not propose it; our response gives an appropriate basis for it.

In the years soon after privatising Britain’s electricity system, ministers enjoyed bragging that the country’s electricity was the second cheapest in Europe; now it’s among the most expensive. At privatisation the UK had one of the world’s most reliable and resilient electricity systems; in recent years our grid has been saturated, dependent on imports through interconnectors and subject to black-outs, near misses and ever-escalating costs.

This consultation response includes the Storelectric documents and web pages to which it links.

Offer

We note the injustice of being relied upon to deliver for free, in our own time, the scope and depth of thinking for which others are paid and not delivering. This has been going on since 2014, during which times many rich consultancies have been paid to advise on a system that continues to deteriorate in cost, reliability and resilience while growing almost exponentially in complexity, while an under-funded start-up delivers the results unpaid. It also leads to our input being under-valued in relation to the input for which these others have been paid. Please also note the credentials of the author (at the end of the document).

We look forward to remuneration in future for such advanced-level input, whether to Storelectric or (if this is deemed a conflict of interest by BEIS / Ofgem) to the author as a private consultant.

Resolving Conflicts of Interest

The Conflicts of Interest

There are indeed conflicts of interest in the governing architecture of the gas and electricity systems, particularly in electricity.

BEIS appears unhappy with the result of the 2019 consultation on this matter, which split up the Network Operators (NOs, consisting of the Transmission Operator [TO] and the Distribution Network Operators [DNOs]) from the Transmission Systems Operator (TSO). It also retained the previous split of Transmission from multiple Distribution operators. Both TO and SO remained in National Grid (NG), separated by Chinese walls under Ofgem's supervision. There is a perception of conflict of interest in the matter, on the basis that grid and non-grid solutions both fall within one organisation.

However there are three elements of the conflict of interest, not two. The third element is when the network and the system have differing priorities, for example:

- ◆ Deciding whether a system challenge (such as a constraint) will be resolved by a network or non-network solution, e.g. by building further NO assets or by contracting from an independently operated plant;
- ◆ Formulating grid strategies and codes in ways that balance both system and network needs and opportunities;
- ◆ Acting as independent arbiter between the two.

There is also a conflict in the operation of markets and platforms, which is why additional Chinese walls were created between NG and Elexon, which is owned by NG.

A third challenge is the impossibility, in the current system, of a plant contracting with both the NO and the SO, when doing so is necessary and only contracting with one is not feasible. Examples include:

- ◆ When inertial storage is used to overcome a grid constraint – it cannot do so without producing inertia and related stability services, for which it must have an equal-length contract to the grid constraint contract;
- ◆ When an offshore wind farm developer wishes to build a project with onshore storage, from which it is currently separated by an OFTO and therefore cannot benefit;
- ◆ If future energy contracts were to differentiate between dispatchable and intermittent energy, or inertial and asynchronous, the wind farm developer would be completely unable to benefit from a project that will deliver the dispatchable and/or inertial energy, and so would have no incentive to develop such projects.

As a result, keeping these functions together in an independent System Operator will not lead to “impartial” decisions or actions, as envisaged on p10.

Structural Proposals

This consultation paper merely proposes to split the SO into a separate entity from the TO, i.e. splitting National Grid, and do little more than that. However, to resolve all the conflicts of interest, another body needs to be created, publicly owned, in which to place all the neutral or arbiter functions of the system, still policed by Ofgem. We dub this Future Systems (FS).

Role	Current System Electricity	Current System Gas	Consultation Proposed System	Storelectric Proposed System
Transmission network operation	NO in NG	NO in NG	NO	NO
Transmission network planning	SO in NG	NO in NG	SO	FS
Grid or non-grid solutions	SO in NG	NO in NG	SO	FS
Contracting for value-added services	SO in NG	n/a	SO	SO
Control centre	SO in NG	n/a	SO	SO
Running trading platforms	Elexon in NG	Elexon in NG	Elexon in SO	Elexon in FS
Grid codes	Independent	Independent	Independent	FS
Standards	SO in NG	NO in NG	SO	Whichever they most affect; FS supervises
Transmission / Distribution grid coordination	SO in NG	NO in NG	SO	Hardware: NO Trading*: SO Strategy: FS
Regulation	Ofgem	Ofgem	Ofgem	Ofgem
Cross-role contracting	Impossible	Impossible	Impossible	FS

FS Future Systems organisation (publicly owned)

NG National Grid

NO Network Operator – the Transmission Operator (TO) and Distribution Network Operators (DNOs)

SO System Operator

* Trading: energy flows, balancing / ancillary / stability / other services

Whether NG retains the TO or the SO is immaterial to these issues; nevertheless it is right to split them so that they can compete with each other for the best solutions.

Also, splitting gas and electricity would ensure that they too compete for the best solutions; for example, between EVs and fuel cell vehicles (the latter based on [electrolysed?] hydrogen passing through the gas grid to filling stations), between heat pumps and hydrogen combustion, between electrifying processes or powering them with hydrogen, and in the siting of electrolysis plants – although none of these decisions are

directly within the two organisations' remit, the prices and services offered will greatly affect them.

Such competition in both fields (splitting SO from TO, and splitting electricity from gas) will reduce system costs in the short and especially medium and long terms.

There is an argument for neither split, namely that if the same company sits on both sides of each fence, it will be agnostic about the way in which the system develops. While this is true, it also removes any incentive to improve, whether in cost, service, capability or quality, as consumers ultimately have no option.

Enhanced Role for Ofgem

Although the above does not show it, there should be an enhanced role for Ofgem in the planning of the grid.

Currently all planning is done by the System Operator, principally via its Network Options Assessment, Future Energy Scenarios and related analyses. These are largely unchallenged within the industry, even though they contain numerous questionable assumptions and even errors. Instead, four such plans for the evolving grid should be developed, based on different assumptions and not all with the same remit, by the FS, NO and SO, and also by Ofgem in order to educate themselves to challenge them (and be challenged by them) and ultimately for them and BEIS to adjudicate between them. Some or all of these may be contracted out, but not to the same bodies as each other. Ofgem and BEIS will be able to benefit from the others' analyses as alternative scenarios, in order better to design legislation, regulations and other interventions.

A Longer Term, Integrated View

New or Enhanced Roles

The “new or enhanced roles and functions ... being developed for National Grid Electricity System Operator (NGESO) or ... the FSO in future” (top of p11) are all suited to the FS (Future Systems organisation), with the exceptions of heat and transport decarbonisation, hydrogen and CCUS whose role properly lie with BEIS. None are appropriate to be done in an organisation with major commercial interests in either the infrastructure or the contracting arrangements.

Desired Characteristics

The listed Desired Characteristics (p11) all apply to every one of the organisations and are therefore not an influencing issue in the matter of how to structure the system; they are only important in considering each organisation’s governance and internal structure.

Among the “three broad categories” of function (p27), the delivery function provides a conflict of interest with the advisory and active policy-setting functions, because the delivery function is focused on operation, whereas there is a separate delivery function for the grid structure, the network operator. The conflict is that the performance of the advisory and active functions will therefore not be impartial between contractual and grid hardware solutions, and nor will it be in a position to ensure that proposals that benefit both receive appropriate and coordinated contracts from both.

Implementation

A “phased implementation” is a superficially attractive buzz-word that agents of change love to use, but will lead to years of uncertainty and constant reorganisation. This will in turn impede and disrupt both the energy transition and all participants in the system.

A sale process will be a “fire sale” which would under-value the assets sold, and therefore leave the government with potential legal liabilities. It would also probably result in foreign ownership of substantial parts of the infrastructure, which is against current government policy. A split can be managed in different ways, the easiest of which risks disrupting the business in the capital markets.

I would be happy to advise on achieving it with minimal fiscal, systemic, organisational and energy-transitional disruption.

The Need to Address Other Issues

None of this will be any benefit without changing the regulatory system entirely. The current system suffers from:

- ◆ Failure to contract for what is needed;
- ◆ Excess focus on the short term to the near-exclusion of the medium and longer terms;
- ◆ Failure to incorporate, within its normal contracting structures, incentives for major capital investment, emissions reduction and the implementation of innovations;

- ◆ Decreasing reliability and resilience;
- ◆ Excess costs due to inability to think and act across all parts of the system, as exemplified in the totally excessive ~£1.25bn capital and ~£125m annual costs per gigawatt of wind farms to be installed by 2025, these sums increasing thereafter;
- ◆ Prevention of beneficial projects by reactive (as opposed to proactive) grid development;
- ◆ And other problems.

All of these result in escalating costs for the system as a whole (hence for the consumer and the country), and ever-increasing need for governmental / regulatory intervention that distorts and destroys the markets that are needed (provided that their incentives are suitable, which they currently are not) to control both costs and quality.

Further analysis of the challenges can be found in Where [Grid Regulation Went Wrong](#), which is an extract from our feedback on the Smart Systems and Flexibility Plan 2021. In that feedback, there is also considerable input as to the design of a regulatory and contractual structure fit for a Net Zero grid.

Other Parts of the Solution

The challenges are listed as those of achieving the energy transition across the economy. The matters of this consultation relate merely to the roles and responsibilities of the players in the system, which is only one part of the solution. There are many other parts that this paper addresses barely or not at all, for example:

- ◆ Regulatory system design;
- ◆ Balancing the interests of incumbents and insurgents (large and small companies, established and new technologies etc.);
- ◆ “Levelling the playing field” (an intention in Ofgem’s foreword);
- ◆ Contracting system design;
- ◆ Process for letting contracts;
- ◆ Cross-system contracting;
- ◆ Incentivisation of emissions reduction;
- ◆ Incentivisation of major private investment;
- ◆ Incentivisation of the introduction of new technologies;
- ◆ Minimising the need for government and regulatory interventions in all the above, by incorporating all these within the main system design and operation;
- ◆ Minimising medium- and long-term costs to the system / consumer, ditto.

We have analysed all these matters extensively, and have much more to propose. We would welcome the opportunity to help BEIS and Ofgem to develop a much cheaper, more competitive, market-based and rigorous approach.

Splitting the System Operator Roles

Roles Proper to the System Operator

The System Operator (SO) should operate the system. This involves:

- ◆ Control room operations;
- ◆ Market development and transactions;
- ◆ Contracting for grid operational services (e.g. balancing, ancillary, stability, other);
- ◆ Standards in relation to provision and delivery of contracts;
- ◆ Bidding (or contributing to bids) for non-network solutions to network challenges.

There is a caveat: Ofgem and the Future Systems Organisation must ensure that tenders / bids offering benefits to the Transmission Operator (TO) too are assessed for ALL their benefits in conjunction with the TO, and that appropriate contracts are awarded based on the sum total of benefits to the system as compared with awarding alternative contracts (including awarding separate contracts for TO and SO).

Roles Proper to the Network Operator

The Network Operator (NO, whether a Transmission Operator TO or a Distribution Network Operator DNO) should build and maintain the system, including grid connections. This includes:

- ◆ Grid and grid-asset construction, maintenance and operation;
- ◆ Standards for grid-connected assets;
- ◆ Grid connections;
- ◆ Bidding (or contributing to bids) for network solutions to network challenges.

Note that, for standards etc., the DNOs should undertake this role collectively rather than individually, e.g. in the Energy Networks Association (ENA). Otherwise the result would be a hotch-potch of different (and even mutually incompatible) standards depending on the region unless there are compelling reasons such as Manweb's unique ring network.

Roles Proper to the Future Systems Organisation

The Future Systems role is strategic for all matters, and tactical for cross-cutting matters and the management of neutral functions such as platforms, standards and grid codes. The organisation should undertake or oversee:

- ◆ System insight, planning and network development;
- ◆ Planning for and achieving the energy transition;
- ◆ Overseeing and approving construction of grid ahead of need;
- ◆ Cross-business contracts;
- ◆ Contracts with extended durations and/or lead times;
- ◆ Running platforms such as Elexon;
- ◆ Standards in relation to the whole system, and cross-cutting standards;
- ◆ Grid codes;
- ◆ Tendering / deciding between grid and non-grid solutions to network challenges;
- ◆ Providing modelling and assessment services for proposals that cut across roles such as SO, NO, OFTO and, where appropriate, overseeing relevant contracts.

New and Enhanced Roles

There are indeed new and enhanced roles to be undertaken. However the proposals in the document suggest a poor understanding of what needs to be done, and of how best it can be done.

Hydrogen

Putting hydrogen into the gas grid should be the role of the Network Operator, as should related planning and upgrades to the network.

Modifications and upgrades for users is a function that lends itself to the private sector. While there may be elements that can best be tendered and contracted nationally, most of this work should be tendered and contracted locally:

1. There are very few businesses that can contract nationally, and most of those would sub-contract, leading to layer upon layer of contracts, profits and coordination risks;
2. The best way to convert the network is area by area, 100% conversions from methane to hydrogen, growing outwards from the [hydrogen hubs](#) currently being developed.

The reason for this conversion strategy is because the gas volume flows change (~50% higher per unit of thermal energy delivered for hydrogen compared with methane), as do flame characteristics including profile/length, hottest part, and temperature. Therefore converting (for example) five times for 20%, 40%, 60%, 80% and 100% hydrogen content would be vastly more costly and disruptive than converting one area at a time from zero to 100% hydrogen.

If BEIS has the capabilities to tender, let and run such contracts, then they should do so; otherwise, the Future Systems organisation should.

CCUS, Heat Networks, Transport Decarbonisation

Carbon Capture, Use and Storage (CCUS) is a totally different matter. Its main foci are:

1. Reducing the cost and improving the effectiveness of carbon capture;
2. Developing and productionising cost-effective uses for CO₂ (the "Use" part);
3. Developing sustainable and cost-effective safety and monitoring systems for use over various lifetimes ranging from 40-60 years (plant-mounted equipment) to 100+ years (pipelines) and thousands of years (underground storage);
4. Ensuring the roll-out of CCUS equipment and networks;
5. Procuring, preparing and operating the storage locations.

1-3 are research and development activities, best suited to BEIS (InnovateUK / UKRI).
4 is best managed by BEIS, administering subsidies through competitively bid contracts.
5 is best done by BEIS, with the preparation and operation sub-contracted.

Roll-out (4) will be supported by the Future Systems organisation's energy transition role, and by Ofgem ensuring that the regulatory and contractual structures incentivise decarbonisation.

The considerations for heat and transport decarbonisation are remarkably similar to those for CCUS and therefore will have very similar solutions.

Planning, Development, Future Operability

Planning the system and overseeing network development, and future operability, are the primary roles of the Future Systems organisation. They would also be best placed to recommend on the energy market design – which Ofgem should enact and oversee.

Disputes, Competition, Engineering Standards, Data

There should be many fewer **disputes** if the roles are split as we propose, because doing so eliminates most of the conflicts of interest. One of the Future Systems organisation's roles is to oversee and manage cross-cutting proposals, projects and contracts. Any disputes that arise above this level can be resolved by Ofgem or, if politically or policy related, BEIS.

Competition between energy networks would not be fair (a heavily biased playing-field) under the consultation proposals, as the planning and strategy would be under the same organisation as grid operation. Moreover, there would be little or no competition between gas and energy networks if under the same roof. Our proposals address all this with minimal regulatory needs.

Coordination with distribution networks happens at different levels and with different functions. It is ludicrous to lump it all together in one organisation: every real-world organisation has interfaces as needed; none shoehorn all interfaces through a single entity. Physical coordination is for the Transmission Operator, and for the DNOs to do between themselves. Provision of balancing, ancillary, stability etc. services is for the System Operator to deliver in coordination with the DNOs (who may acquire more DSO roles). Planning the entire network would be for the Future Systems organisation.

Distribution network **engineering standards** (including for assets connected to the network) are for the distribution networks themselves, through a common organisation like the ENA; similarly transmission network standards (ditto) are for the TO.

Data are for each organisation to provide. It should be for Ofgem to ensure that each is sufficiently open and provides sufficient user-friendly data – and on common formats wherever appropriate.

Grid Codes

Grid codes would rest with the Future Systems organisation. The way that they are managed needs a major overhaul: they are the exclusive domain of large incumbents who have the resources and expertise, and whose interests lie in excluding insurgents.

Grid code managers should be employed by the Future Systems organisation. Membership of the teams to revise each group of standards should be one member per grouping, so that each grouping's views carry near-equal weight. Example groupings are:

- ◆ Transmission network operators
- ◆ Distribution network operators
- ◆ Power stations (dispatchable and/or baseload)
- ◆ Renewable generators (intermittent)
- ◆ Grid service providers (e.g. storage, peaking plants)
- ◆ Large energy users
- ◆ Medium energy users (companies)
- ◆ Small business users
- ◆ Individual consumers

Representation should be by organisations (who can, if wanted, use a delegated member) and paid for by the Future Systems organisation, on a flat rate that includes sufficient for the representative, any support they need, overhead and a margin. Organisations should bid competitively for the role, to be adjudged by (among other things) the quality of candidate offered and the range of organisations / individuals they represent.

Questions

1. Yes, but not as described. It needs to be more radical, separating (a) network operator from system operator from future systems organisation and (b) electricity from gas. See Structural Proposals, above.
2. Not as proposed, which will merely perpetuate current conflicts of interest between system planning and operation, and current inability to deliver and monetise whole-system benefits from optimal projects. See The Conflicts of Interest, above.
3. No: electricity and gas will, in future, compete in many fields including heating (heat pumps v hydrogen), transportation (EVs v fuel cells) and the siting of electrolysis. Separating them will ensure that they compete; keeping them together will remove incentives to improve. See Structural Proposals, above.
4. Yes, but also with the roles outlined by this report to be split in two: the System Operator who operates the system, and Future Systems who plans, develops and consults on strategies sensitivities and scenarios, adjudicates between network operator and system operator, and ensures that cross-cutting projects and benefits are both achievable and monetizable. See Structural Proposals, above.
5. The system is riven with conflicts of interest (see above), perverse incentives, short termism and siloed thinking (see [Where Grid Regulation Went Wrong](#)).
6. Any proposal that (a) has benefits for both contracting and grid infrastructure; (b) has both offshore and onshore elements; (c) can address future energy contracts if they were to differentiate between dispatchable and intermittent energy, or inertial and asynchronous; (d) need longer contracts or starting lead times.
7. There are many areas to be addressed, on which we have advised frequently (for example in our input to the Smart Systems and Flexibility Plan 2021). These include:
 - ◆ Conflicts of interest (the subject of this paper);
 - ◆ Regulatory regime;
 - ◆ [Regulatory definition of storage](#) (it is not generation: it generates no new electrons, merely moving them in time like interconnectors move them in space; storage needs its own definition based on that of interconnectors in order to level the playing field and stop forcing the British grid to subsidise overseas generation);
 - ◆ Contract structures;
 - ◆ Contracting, tendering and assessment methodologies;
 - ◆ Siloed ([salami-slicing](#)) thinking;
 - ◆ Short-termism in planning, construction and [contracts](#);
 - ◆ Favouring incumbents over insurgents (large and small companies, established and new technologies etc.) – it's mostly the insurgents who have the solutions to the energy transition.
8. No, due to the conflicts between matters that involve both the network operator and the system operator, or that set one operator against the other (such as assessing non-network solutions to network problems). The roles should be split as outlined above, Splitting the System Operator Roles.
9. No, the energy transition creates conflicts of interest between electricity and gas grids which separation and competition between them will best (and most cost-effectively) resolve. See The Conflicts of Interest, above.

10. No. It will address neither the majority of The Conflicts of Interest, above, nor a large number of issues that are not addressed by this proposal (see answers to Q5 and Q7, above).
11. The single advisory role proposed by this consultation is preposterous, not fit for purpose. It places responsibilities inappropriately on the organisation that should lie elsewhere, some of them being best split rather than artificially combined. The roles are much better split as we outline above (New and Enhanced Roles). The costs of the System Operator and the Future Systems organisation should be borne by levies and charges, as at present. (These levies and charges need restructuring too, as per our feedback on the Smart Systems and Flexibility Plan 2021.)
12. Yes, as per Q11.
13. The characteristics and attributes apply almost equally to all the entities under consideration and are largely uncontroversial.
14. The organisation model is wrong. The proposed FSO needs to be further divided into System Operator (a regulated private entity) and Future Systems organisation (a public body; for lack of a better word, a quango). Gas and electricity private entities should be split in order to create competition between them, though the Future Systems organisation may cover both. The Future Systems organisation should wholly own Elexon, Xoserve and any other related platforms, including any interests in European trading platforms.
15. No, the regulatory and accountability frameworks should be as per Q14 and the above complete submission.
16. The Future Systems organisation should be wholly publicly owned. The other organisations are private; shareholdings of 10% and above (i.e. sufficient to have enhanced shareholder rights) should always be scrutinised for both competition and national interest, as should the demands of groups of shareholders to appoint a director.
17. The principal considerations regarding Elexon and Xoserve have been completely overlooked. They are platforms of national importance (to the economy, energy industry, other industries and national security) which must be run neutrally for all industry players and shielded from distortion of intent by any party. As such, public ownership is most appropriate.
18. The implementation approach should not be “gradualist” but quick and clean.
 - ◆ A gradual, staged approach is fashionable these days, but will create years of constant change and hence uncertainty at a time when the main players in the country’s energy systems need to move fast and decisively in order to stand a chance of achieving governmental Net Zero ambitions. This period of uncertainty would provide a constant backdrop of inward-looking, as opposed to forward-looking, focus, which would prevent the necessary decisions, regulations, frameworks and structures being decided and enacted in a timely and well-considered manner.
 - ◆ The functions can swiftly be moved into the appropriate sub-organisations, then the current organisations split formally and commercially. I would be happy to advise on doing so in the fairest way to National Grid as well as the quickest, cleanest and least disruptive way for all other industry players.

- ◆ But the end result should be the structure that we propose, NOT that proposed by the consultation paper.
19. The roles should be as proposed above, not as proposed in the consultation paper. The most urgent priorities for development include:
- ◆ Enabling cross-cutting planning, evaluation & contracts, including long durations;
 - ◆ Changing regulations to enable, for example,
 - ◇ Cross-cutting contracts, across onshore and offshore networks and system operation / contracting,
 - ◇ Integrated contracts for services from a plant / installation that cannot reasonably or cost-effectively be separated,
 - ◇ Sharing of infrastructure benefits (both capex and opex),
 - ◇ Projects with both offshore and onshore elements to gain from their synergies;
 - ◇ Correct regulatory definition of storage as storage, a grid service / capability like interconnectors or substations,
 - ◇ And other necessary requirements – see our inputs to the Smart Systems and Flexibility Plan, Facilitating the deployment of large-scale and long-duration electricity storage consultation and other related inputs;
 - ◆ The 30- and 50-year planning horizons;
 - ◆ Independent planning on these horizons by all the bodies cited (including independently by Ofgem), in relation to their strategic and operational remits;
 - ◆ Proactive grid construction;
 - ◆ Establishment of Future Systems organisation led grid code management, with committees consisting of paid-for members from industry bodies.
20. The risks are manifold, including:
- ◆ Groupthink, such as this consultation paper;
 - ◆ Incrementalism, such as this consultation paper;
 - ◆ Failure to remove / reduce conflicts of interest by (for example) keeping grid operation and strategic planning together, or keeping electricity and gas together;
 - ◆ Failure to enact radical regulatory change, to redress the problems that have got us to this bad and deteriorating system, and to enable the most cost-effective, reliable and resilient (and least disruptive) energy transition and Net Zero grid.
21. The impact of the proposals will include (all mitigated or eliminated by our proposals):
- ◆ Perpetuating conflicts of interest and making them harder to resolve;
 - ◆ Ditto problematical aspects of regulatory systems;
 - ◆ Delaying / slowing the energy transition due to extended periods of regulatory and organisational uncertainty;
 - ◆ Excessively expensive energy transition with vastly increased need for regulatory and governmental interventions;
 - ◆ Keeping too much of the burden for financing the energy transition in government, rather than creating the appropriate incentives that will bring in sufficient private investment into the required capabilities;
 - ◆ Ever-increasing consumer bills;
 - ◆ Grid codes that remain captured by large incumbents whose interests lie in excluding insurgent businesses and technologies, and in perpetuating business-as-usual and incrementalism.

Grid-scale electricity storage enabling renewables to power grids affordably, reliably and resiliently

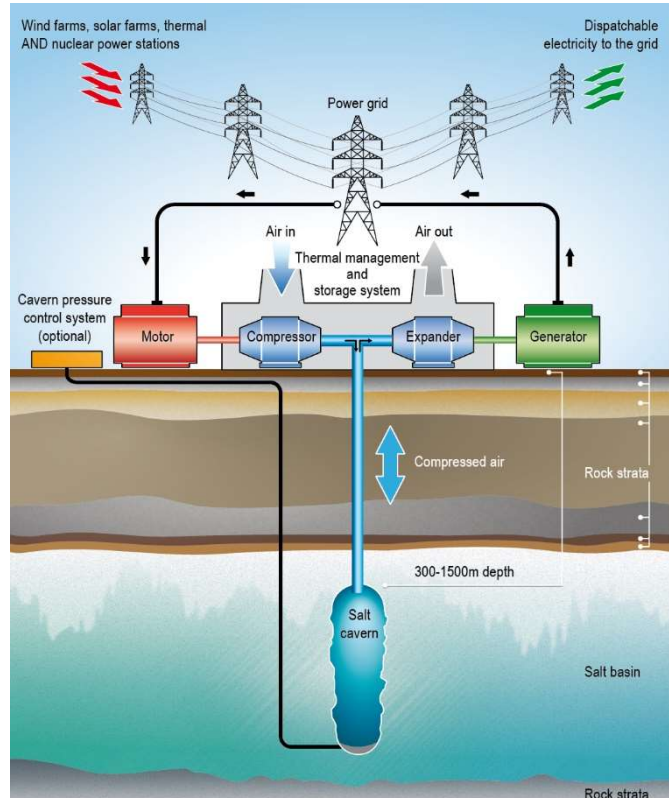


About Storelectric

Storelectric (www.storelectric.com) is developing transmission and distribution grid-scale energy storage to enable renewables to power grids reliably and cost-effectively: the world's most cost-effective and widely implementable large-scale energy storage technology, turning locally generated renewable energy into dispatchable electricity, no... **enabling renewables to power grids cheaply, efficiently, reliably and resiliently.**

- ♦ Innovative adiabatic Compressed Air Energy Storage (Green CAES) will have zero / low emissions, operate at 68-70% round trip efficiency, levelised cost significantly below that of gas-fired peaking plants, and use existing, off-the-shelf equipment.
- ♦ Hydrogen CAES technology converts & gives new economic life to gas-fired power stations, reducing emissions and adding storage revenues; hydrogen compatible.

Both technologies will operate at scales of 20MW to multi-GW and durations from 4 hours to multi-day. With the potential to store the entire continent's energy requirements for over a week, global potential is greater still. In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES, all of which will greatly improve storage cost, duration, efficiency and global potential.



About the Author



Mark Howitt is Chief Technical Officer, a founding director of Storelectric. He is also a United Nations expert advisor in energy transition technologies, economics, regulation and politics – [invitation here](#).

A graduate in Physics with Electronics, he has 12 years' management and innovation consultancy experience world-wide. In a rail multinational, Mark transformed processes and developed 3 profitable and successful businesses: in commercialising a non-destructive technology he had innovated, in logistics (innovating services) and in equipment overhaul. In electronics manufacturing, he developed and introduced to the markets 5 product ranges and helped 2 businesses expand into new markets.

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